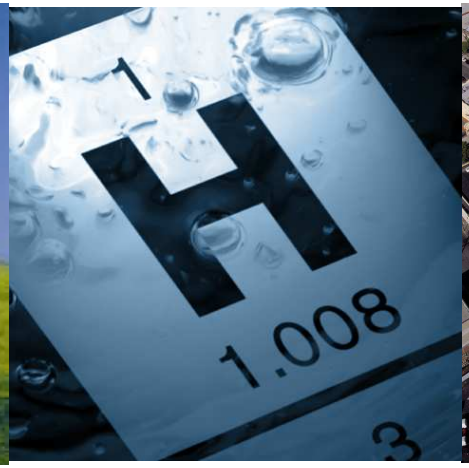
SOLAR INTEGRATED TECHNOLOGIES

RENEWABLE HYDROGEN PATHWAY

CaH²Net Hydrogen Workshop

Jon Slangerup, CEO

Solar Integrated Technologies



Hydrogen 101

- Hydrogen (H^2) is the most abundant element in the Universe
- H^2 has been proven safe and reliable as an energy carrier and fuel source
- Commercial market for industrial H^2 exceeds $50B annually
  - >60% used in oil refining
  - >30% used in industrial manufacturing
  - <10% used in emerging applications, e.g. transportation and power

- H^2 technology is mature, affordable, adaptable and scaleable
- H^2 is primarily produced from either fossil fuel reformation or water electrolysis

H^2 Production: Two Options

- H^2 production today is based primarily on fossil fuel reformation
  - Steam Methane Reforming (SMR) using natural gas (NG) is most common
  - SMR is least expensive H^2 production process
  - SMR generates significant amounts of green house gas emissions
- Water electrolysis is the growing alternative H^2 production process
  - H^2 produced from water and electricity
  - Cost of electrolytic H^2 is directly proportional to cost of electricity
  - Electrolytic H^2 is emission-free when produced from renewable electricity
- Renewable H^2 (RH^2) is only long-term path to mitigating energy security and air quality risks

H^2 Economics

- H^2 versus gasoline
  - One kilogram (kg) of H^2 is the energy equivalent of about 1 gallon of gas
  - One kg of H^2 sells for $5 to $75 based upon volume sold and production method
  - H^2, when used in either an engine or fuel cell, is 30-60% more efficient than gas

- SMR-produced H^2 sells for $5 to >$75 per kg
  - Economics based on costs of physical distribution and large volume production; e.g. the larger the delivered order the lower the cost
- Electrolytic H^2 sells for $7 to $15 per kg
  - Economics based on size of on-site production facility and cost of electricity
  - 1 kg of H^2 consumes 55-60 kilowatt hours (kWh) of electricity, e.g. each penny per kWh equals 55-60 cents per kg of H^2 ($.10/kWh = $5.50 H^2/kg)

Is Renewable H^2 A Viable Option?

- Yes, long-term
  - RH^2 is the only long-term pathway to clean and secure energy
  - Rising cost of oil is driving factor based on declining reserves and political risks
  - Deteriorating air quality and climate change are sustaining factors due to human health and welfare impacts

- Short-term needs
  - Increased incentives for RH^2 production and product development
  - Public awareness and continued political leadership – SB1 and CaH2Net are solid steps forward
  - Equivalent of Apollo Project to prepare infrastructure now to ensure widespread adoption of H^2 vehicle and power products after 2010

Opportunities & Constraints

- RH^2 is technically viable but dependent upon subsidy in the short-term until scale and mass adoption are achieved
  - H^2 storage technology and harmonized codes and standards are biggest hurdles facing near-term H2 adoption
- Wind power initiatives are losing momentum due to subsidy and capital constraints – industry needs to be revitalized
- Solar initiatives are gaining momentum due to increasing incentives and available capital
  - Solar is ideal companion for RH^2 applications based on distributed power attributes of on-site generation of electricity and H^2
  - Industry photovoltaic supply shortfall is driving significant capitalization
  - Billions of square miles of flat industrial roofs are beginning to be targeted in next wave of solar capacity expansion

Summary

- H^2 is a mature and vital industry using proven, adaptable technology
- Oil is a declining resource, while renewable energy is an abundant and sustainable resource dependent short-term on subsidies
- RH^2 is the only long-term path to mitigating energy security and air quality risks on a global scale